"Customers" arrive in batches of size $K$, with batch arrivals forming a Poisson process with rate $\lambda$.

Service time for each customer has exponential distribution with mean $\frac{1}{K\mu}$, i.e., time to process the batch has mean $\frac{1}{\mu}$. 
Continuous-Time Markov Chain

K=3

Not a birth-death process!

Continuous-Time Markov Chain

K=3

This C-T Markov chain is equivalent to that for the M/E_k/1 queue!
Bulk Arrivals, with Random-Sized Batches

Let \( \lambda \) = arrival rate of batches
\[ \alpha_k \] = probability that batch contains \( k \) customers, \( k = 1, 2, 3, \ldots K \)
\( \mu \) = service rate for each customer

\[ \begin{align*}
\lambda \pi_0 &= \mu \pi_1 \\
\vdots & \\
[(\alpha_1 + \alpha_2 + \cdots)\lambda + \mu] \pi_m &= \mu \pi_{m+1} + \sum_{k=1}^{m-1} \alpha_k \lambda \pi_{m-k}
\end{align*} \]

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